DEPARTMENT OF CONSERVATION
Managing California's Working Lands
DIVISION OF OIL, GAS, & GEOTHERMAL RESOURCES

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

July 30, 2015

Mr. Steven Anthony Reid
California Resources Corporation (CRC) Elk Hills
10800 Stockdale Highway
Bakersfield, CA 93311
Tony.Reid@crc.com

Dear Mr. Reid:

ADDITIONAL COMMENTS ON CALIFORNIA RESOURCES CORPORATION ELK HILLS, TULARE AQUIFER EXEMPTION DOCUMENT, ELK HILLS FIELD

Thank you for providing additional information following our May 20, 2015 meeting regarding the Elk Hills aquifer exemption. The Division of Oil, Gas, and Geothermal Resources (Division) and the State Water Resources Control Board (State Water Board) have collaborated in preparing this joint letter.

State Water Board and Regional Water Quality Control Board (collectively Water Boards) and Division staff have carefully reviewed the information provided by CRC and observe that fluids injected in the southwestern flank of the Elk Hills anticline do not appear to be contained by a geologic feature preventing injected fluid flow toward waters of beneficial use. Based upon information provided by CRC, there is a potential that injected fluids could flow toward the Buena Vista Lake bed, which according to the Department of Water Resources (DWR) well completion report database have 65 water supply wells that currently or in the past served as a source of beneficial use waters. These water supply wells appear to be completed in the Tulare Formation, which is the principal water bearing zone for water supply wells in the Southern San Joaquin Valley. As a result of this information, Division and State Water Board staff have reevaluated our position regarding this portion of Elk Hills, including the area identified in the State Water Board's February 11, 2015 letter (Attachment 1), due in large part to the potential risk that injection in the southwestern flank of the Elk Hills anticline poses to beneficial use waters.

Based upon discussion of these concerns at the last few meetings, we understand that CRC is requesting the state consider an aquifer exemption exclusively for the zone beneath the Tulare Clay on the south side of the anticline, and exclusively for the zone beneath the Amnicola Clay on the north side of the anticline to accommodate CRC's existing injection operations. If this understanding is incorrect, please clarify.

In order to proceed with an aquifer exemption for the south side of the Elk Hills anticline below the Tulare Clay, CRC must provide a technical demonstration that either the injectate will remain contained in the proposed aquifer exemption area or that waters of current and future beneficial uses will not be impacted by the injectate. If CRC would like to continue to pursue an aquifer exemption for the south side of the Elk Hills anticline, we suggest that the information listed below be provided to the Division and the State Water Board.

Assessment of Current Beneficial Uses of Water

A water supply well survey should be conducted that identifies the location of all water supply wells (municipal, domestic, irrigation, and industrial) in sections 20 through 28 in T31S, R24E; MDB&M and sections 19 and 30 in T31S, R25E; MDB&M. The public can now obtain well completion reports from DWR; information on requesting the reports is available at http://www.water.ca.gov/groundwater/wells/well_completion_reports.cfm.

The well survey should be supplemented by an on-the-ground well survey in order to verify the condition of the wells identified through the DWR well completion report survey and include wells not listed in the DWR database. The following information, as available, from the well survey should be listed in a table:

- Well name or identification number,
- Well location,
- Year well was constructed,
- Well type (municipal, domestic, irrigation, or industrial),
- Well status (active, inactive, abandoned, or destroyed),
- Total depth, screen interval, annular seal and gravel pack information, and lithologic description(s) including formation names (e.g. Upper Tulare, Lower Tulare),
- Any available water quality data for the identified wells, and
- Identification of which wells may be completed below the Tulare Clay.

Assess Potential Future Beneficial Uses of Water

Water quality samples should be collected from the zone beneath the Tulare Clay near the depression of the former Buena Vista Lake bed to assess if groundwater in this zone is of potential beneficial use. Water supply wells that are clearly shown to be completed and screened only beneath the Tulare Clay may be considered to be used for collecting water quality samples. If there are no water supply wells completed and screened only beneath the Tulare Clay in this area, then a dedicated groundwater monitoring well should be installed and water samples collected. In either of these sampling scenarios, a proposal for groundwater sample collection beneath the Tulare Clay zone would need to be submitted to Water Boards staff for review prior to sample collection.

Demonstrate that the Tulare Clay is a Continuous Confining Layer

If results of the well survey and water quality sampling below the Tulare Clay indicate that groundwater in this zone is not considered to be of current or future beneficial use, then CRC will need to technically demonstrate that the Tulare Clay is a continuous, low permeability layer that would essentially prevent

the vertical migration of water between the aquifers above and below the Tulare Clay throughout both the proposed exempted areas and adjacent areas that may have current or future beneficial uses of water. This could be demonstrated using the suggested approach that the State Water Board and

Division outlined in its letter to CRC dated April 28, 2015 (Attachment 2) for the north side of the Elk Hills anticline. The suggested approach includes demonstrating the competence and lateral extent of the Tulare Clay by continuous core sampling and hydraulic conductivity testing, and installing wells completed above and below the Tulare Clay. These borings and monitoring wells would also utilize downhole geophysical (e.g. electrical logs) and hydrogeologic tests (e.g. aquifer testing). In addition, water samples could be collected above and below the Tulare Clay and tested for groundwater characteristics (e.g. cations and anions), general water chemistry analyses, and age dating.

Evaluation of Alternatives to Existing Injection Operations to Reduce Proposed Extent of Exemption

The Water Boards and the Division are conducting a statewide review of approved and proposed injection projects and we are working closely with operators and other stakeholders in the evaluation of existing injection projects to evaluate current and future production to meet the State's energy needs and protect the State's water supply. As part of that review, the Division is evaluating the number, type, and location of existing injection projects and working closely with operators and other stakeholders to evaluate the contribution of those injection projects to the State's energy needs while considering the State's needs for increased groundwater production and protection of the groundwater for future beneficial uses.

The Division is working in close cooperation with operators to evaluate modifications to existing and near-future injection operations to reduce the amount, and more carefully regulate the type, of injection into zones that require an aquifer exemption when the purpose of the injection is not for enhanced recovery. Operators are strongly encouraged to continue to share detailed technical information to demonstrate the current and near-future injection operations will have the least potential impact to beneficial use groundwater when proposing to support the extent of a current exemption, or proposing to exempt a portion of an underground source of drinking water (USDW) to facilitate current or near-future injection when that injection is not specifically for enhanced recovery.

The Division is specifically looking for opportunities to reorganize injection operations to reuse produced water for waterflood, pressure support, or steam generation instead of disposal; adjust the chemistry of the produced water to yield a higher beneficial use such as irrigation; inject produced water into zones that do not meet the definition of a USDW and therefore do not require an aquifer exemption; and to reduce as much as possible the volume of produced water required to be injected into a zone that would require the State to prepare an aquifer exemption application for submission to the United States Environmental Protection Agency (EPA) for consideration.

The extent of the exemption proposed by CRC is related to the quality and quantity of water currently injected into the Tulare for disposal; the number and location of injection wells and injection intervals; the length of time injection has been occurring; and the proposed injection duration for continued injection. The Division has been meeting with CRC to discuss alternatives to CRC's current disposal injection operations to identify opportunities for CRC to reduce the volume and/or improve the quality

of the water injected into the Tulare. Division staff identified a number of alternatives available to CRC to reduce the volume of injection in the Tulare including redirecting injection into formations below the Tulare which do not require an exemption. These formations include the San Joaquin, Reef Ridge, and Etchegoin. Division staff also discussed with CRC opportunities to reduce the volume of injection into the Tulare by reusing more produced water for existing and potential new waterflood projects.

Division staff also suggested CRC consider treating produced water so that the injection does not degrade groundwater quality, and work with local water districts to reuse produced water for irrigation, groundwater recharge, or other beneficial uses. On July 17, 2015, Division staff met with CRC to again discuss these options and CRC informed Division staff at that time that CRC is declining to modify its current injection operations. In reviewing the most recent technical information submitted by CRC, and in consultation with you and your staff during numerous meetings, we understand the CRC is not proposing any alteration of CRC's current injection operations at CRC's Elk Hills field. Instead, CRC has chosen to focus on demonstrating that fluids injected in the southwestern flank of the Elk Hills anticline are contained by a geologic feature preventing injected fluid flow toward waters of beneficial use. As stated above, our initial evaluation indicates a potential risk to groundwater with beneficial uses in the area of the Buena Vista Lake bed. Therefore, we continue to urge CRC to strongly consider the alternatives that we have outlined above.

If CRC does not elect to continue to pursue an aquifer exemption for the remaining portions of the Elk Hills Field, or if the additional collected information does not conclusively demonstrate that the injected fluids will remain in the proposed exempted areas or will not impact current or potential future beneficial uses of groundwater, then alternatives to CRC's current injection operations will need to be explored. We are available to assist CRC with evaluating those alternatives.

If you have questions or comments on any of these matters we will be available to discuss them at our meeting on August 6, 2015. Additionally, if it would be helpful to have us clarify or provide a further explanation of these matters in advance of the meeting you should feel free to let us know.

Sincerely,

Jonathan Bishop
Chief Deputy Director
State Water Resources Control Board

Steven R. Bohlen,
State Oil & Gas Supervisor
Department of Conservation
Division of Oil, Gas & Geothermal Resources

Attachments (2)

cc:

Cliff Rechtschaffen, Senior Advisor, Governor's Office

John Laird, Secretary, California Natural Resources Agency

Matthew Rodriquez, Secretary, California Environmental Protection Agency

[Via email]
Clay Rodgers, Assistant Executive Officer, Central Valley Regional Water Quality Control Board
clay.rodgers@waterboards.ca.gov

John Geroch, Chief Deputy, Division of Oil, Gas & Geothermal Resources
john.geroch@conservation.ca.gov

John Borkovich, Groundwater Monitoring and Assessment Section Chief,
State Water Resources Control Board, Division of Water Quality
john.borkovich@waterboards.ca.gov

Attachment 1

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

FEB 11 2015

Steven R. Bohlen, State Oil & Gas Supervisor
Department of Conservation
Division of Oil, Gas & Geothermal Resources
801 K Street, MS 18-05
Sacramento, CA 95814-3530
steven.bohlen@conservation.ca.gov

Dear Mr. Bohlen:

COMMENTS ON THE OCCIDENTAL OF ELK HILLS, INC. TULARE AQUIFER EXEMPTION DOCUMENT, ELKS HILLS FIELD

State Water Resources Control Board staff, in consultation with the Central Valley Regional Water Quality Control Board staff (collectively Water Boards), have reviewed the Occidental of Elk Hills, Inc., Tulare Aquifer Exemption Document, Elk Hills Field (Exemption Request), dated September 14, 2014. The Exemption Request, forwarded to Water Board staff on October 24, 2014, proposes an aquifer exemption for the entire saturated upper Tulare zone and both the unsaturated and saturated lower Tulare zone below the Amnicola claystone within an area of approximately 59 square miles, or about 80 percent of the Elk Hills field (See Attachment 1).

Based on the information provided, Water Boards staff concur with the Exemption Request only for the following areas: All of Sections 32R and 33R in Township 30S, Range 23E; and 1B, 2B, 3B, 4B, 10B, 11B, 12B, and 13B in Township 31S, Range 23E (See Attachment 2). However, this determination will be reevaluated if future information becomes available.

State Water Boards staff do not concur with the Exemption Request for the remaining areas at this time in part due to the lack of a sufficient demonstration that the injection fluid will be confined to the intended zone or zones of injection. As a result, additional information is recommended for the remaining portions of the Exemption Request (See Attachment 3).

If you have any questions regarding this matter, please contact Mr. John Borkovich at (916) 341-5779 or john.borkovich@waterboards.ca.gov.

Sincerely,

Jonathan Bishop
Chief Deputy Director

Attachments (3)

cc: [Via email]

Stephen Anthony Reid
California Resources Elk Hills, LLC
tony_reid@oxy.com

Clay Rodgers, Assistant Executive Officer
Central Valley Regional Water Quality Control Board
clay.rodgers@waterboards.ca.gov

Rob Habel, Technical Program Manager
Department of Conservation
Division of Oil, Gas & Geothermal Resources
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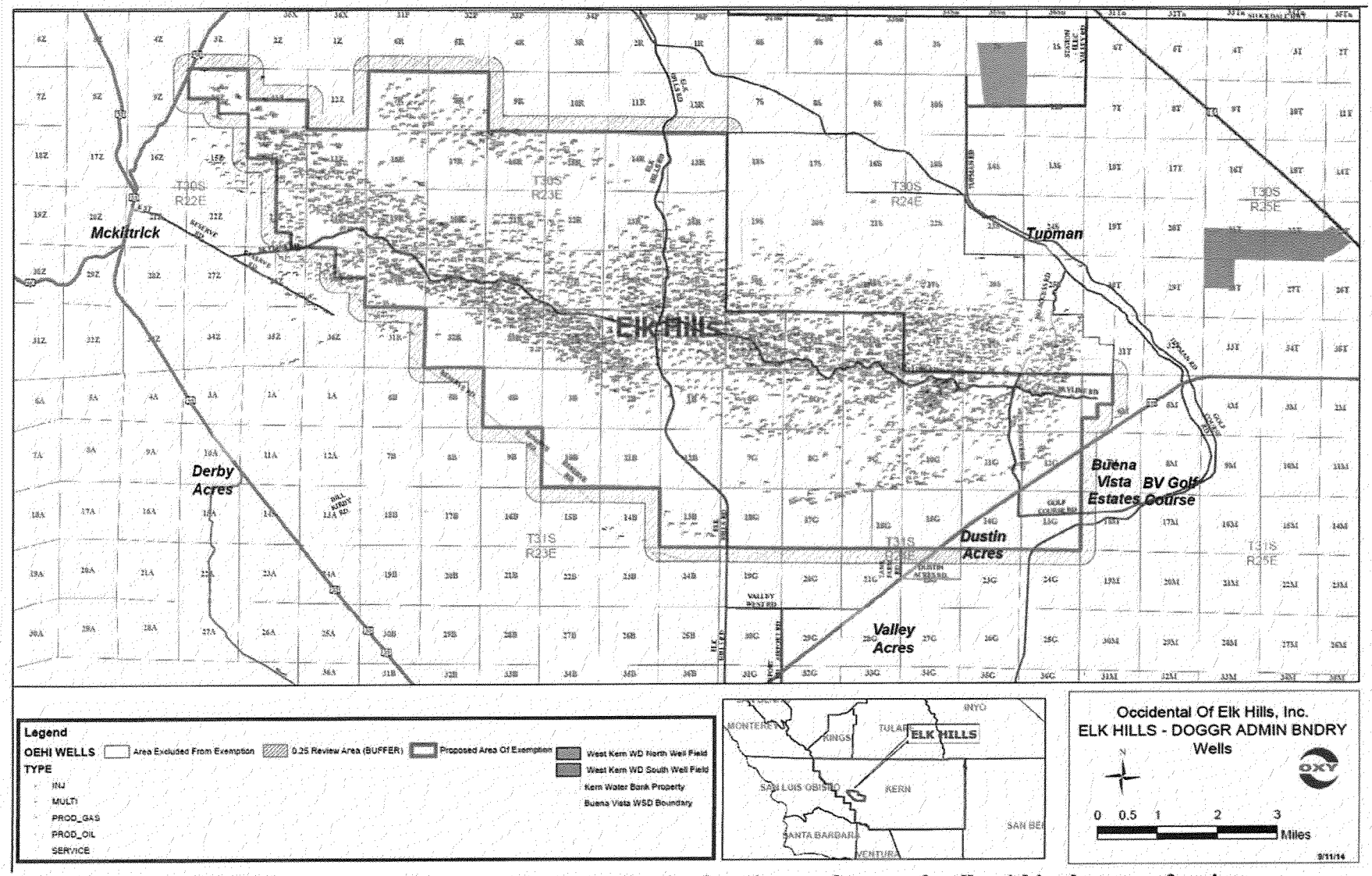
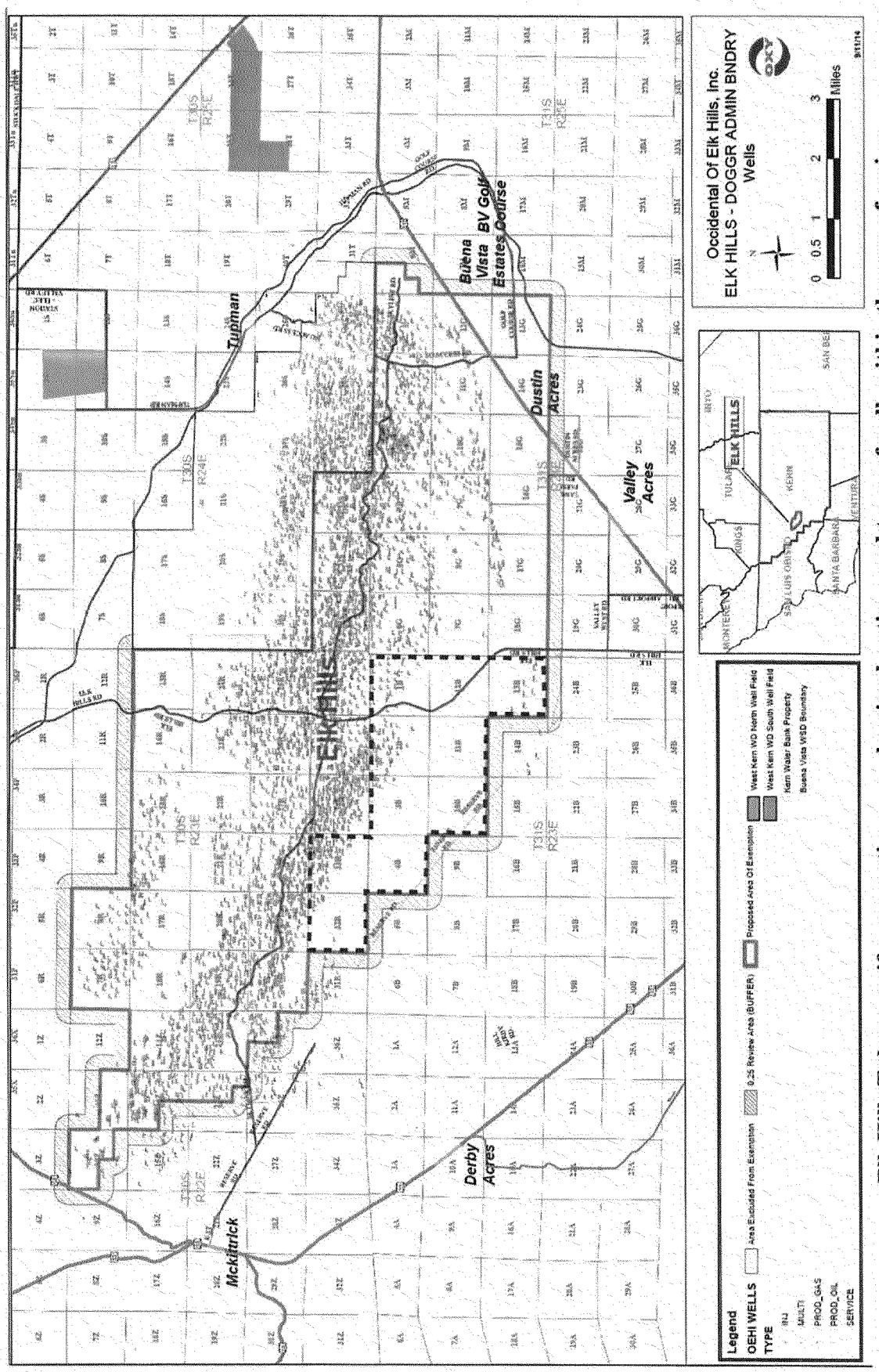
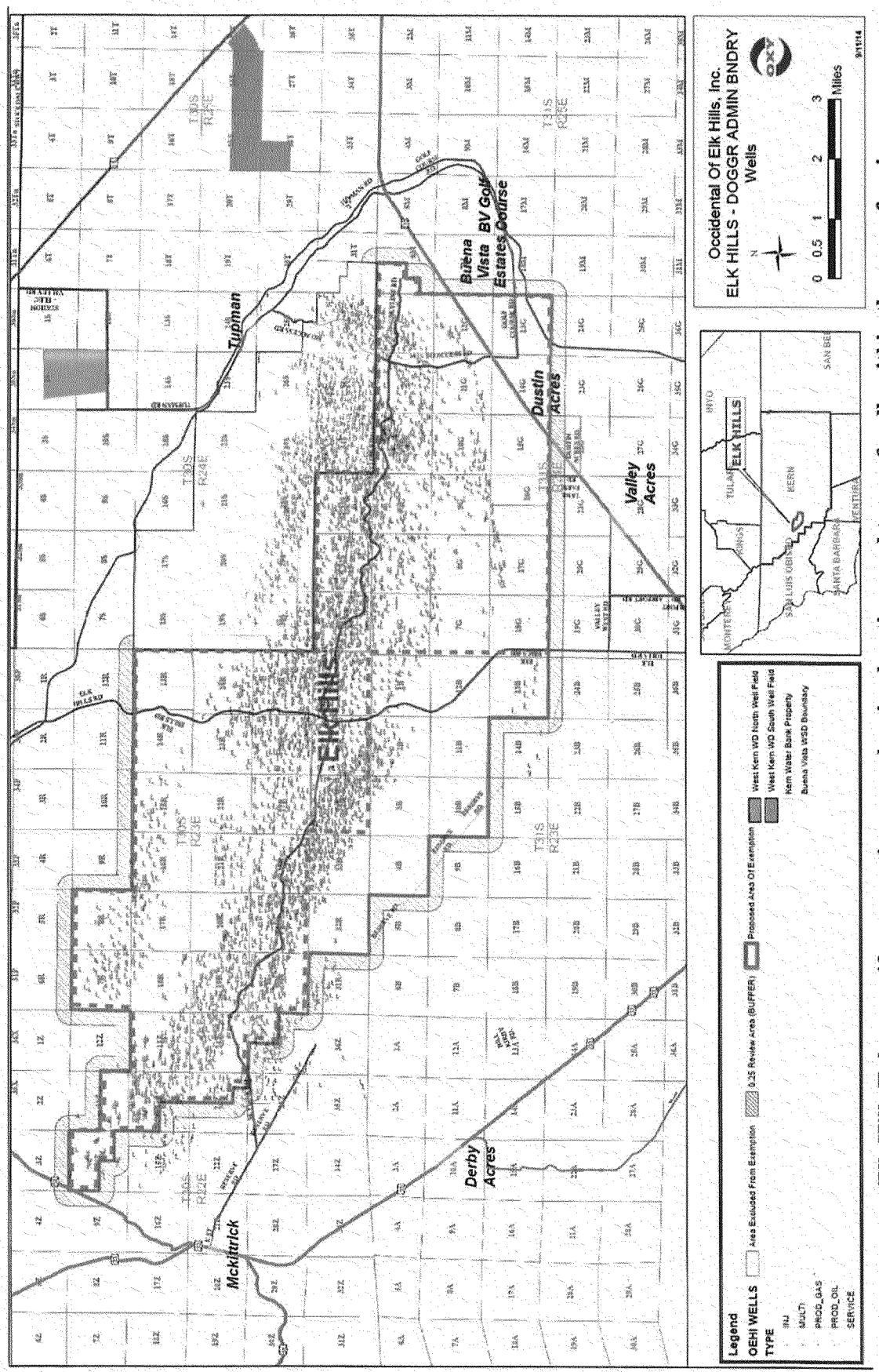


Elk Hills Tulare aquifer exemption area showing locations and types of wells within the area of review



Elk Hills Tulare aquifer exemption area showing locations and types of wells within the area of review

*Water Boards staff concur with the Exemption Request for all of Sections 32R, and 33R in Township 30S, Range 23E; and 1B, 2B, 3B, 4B, 10B, 11B, 12B, and 13B in Township 31S, Range 23E.



Elk Hills Tulare aquifer exemption area showing locations and types of wells within the area of review

*Additional information is required for the remaining portions of the Exemption Request.

Attachment 2

DEPARTMENT OF CONSERVATION
Managing California's Working Lands
DIVISION OF OIL, GAS, & GEOTHERMAL RESOURCES

CALIFORNIA Water Boards

April 28, 2015

Mr. Steven Anthony Reid
California Resources Corporation
10800 Stockdale Highway
Bakersfield, CA 93311
Tony.Reid@crc.com

Dear Mr. Reid:

FOLLOW-UP COMMENTS ON CALIFORNIA RESOURCES CORPORATION ELK HILLS, TULARE AQUIFER EXEMPTION DOCUMENT, ELK HILLS FIELD

The Division of Oil, Gas & Geothermal Resources (Division), State Water Resources Control Board, and the Central Valley Regional Water Quality Control Board have reviewed the information submitted by California Resources Corporation (CRC, Formerly Occidental) of Elk Hills, Tulare Aquifer Exemption Document, Elk Hills Field (Exemption Document), dated September 14, 2014.

The CRC Exemption Document proposes an aquifer exemption for the entire saturated upper Tulare zone and both the unsaturated and saturated lower Tulare zone (below the Amnicola Claystone) within an area of approximately 59 square miles. Based on the information provided thus far, the agencies concur that CRC has conclusively demonstrated that fluids injected into a portion of the Elk Hills Field proposed for exemption will be contained so that the injected fluids cannot affect waters that are being beneficially used, or that are likely to be beneficially used in the future. Therefore, the Division is moving forward with an aquifer exemption application to the U.S. Environmental Protection Agency (US EPA) only for the following areas: Sections 32R and 33R, T30S, R23E, and Sections 1B, 2B, 3B, 4B, 10B, 11B, 12B, and 13B, T31S, R23E, of the Elk Hills Field.

The information submitted by CRC does not provide a sufficient technical demonstration that the fluids injected into the remainder of the Elk Hills Field proposed for exemption will be contained so that the injected fluids cannot affect any waters that are being beneficially used, or that are likely to be beneficially used in the future. If CRC would like to continue to pursue aquifer exemptions for any other portions of the Elk Hills Field, CRC will need to demonstrate conclusively that injected fluids will remain in the proposed exempted areas. In order for CRC to make a sufficient demonstration, geophysical tests, hydrogeologic tests, geologic borings, and laboratory analyses are recommended to show that the Amnicola Claystone is a continuous, impermeable layer throughout both the proposed exempted areas and adjacent areas that may have current or future beneficial uses of water. For example, the competence and lateral extent of the Amnicola Claystone could be demonstrated by continuous core sampling and hydraulic conductivity testing, and installing a sufficient number of multi-depth wells completed above and below the Amnicola Claystone. These borings and monitoring wells would also utilize downhole geophysical (e.g. electrical logs) and hydrogeologic tests (e.g. aquifer testing). In

addition, water samples could be collected above and below the Amnicola Claystone and tested for groundwater characteristics (e.g. cations and anions), general water chemistry analyses, and age dating. In order for the state agencies to fully evaluate this additional data and analyses and provide sufficient time for the US EPA to consider an aquifer exemption prior to February 15, 2017, we request that all data and analyses be submitted no later than June 30, 2016.

If CRC does not elect to continue to pursue an aquifer exemption for the remaining portions of the Elk Hills Field, or if the additional collected information does not conclusively demonstrate that the injected fluids will remain in the proposed exempted areas, then alternative methods of disposal will need to be explored. We are available to assist CRC with evaluating alternative methods, including treatment and reuse of the fluids.

Sincerely,

Jonathan Bishop
Chief Deputy Director
State Water Resources Control Board

Steven R. Bohlen,
State Oil & Gas Supervisor
Department of Conservation
Division of Oil, Gas & Geothermal Resources

cc:
[Via email]

Clay Rodgers, Assistant Executive Officer Central Valley Regional Water Quality Control Board, clay.rodgers@waterboards.ca.gov

Rob Habel, Technical Program Manager, Department of Conservation Division of Oil, Gas & Geothermal Resources, rob.habel@conservation.ca.gov

John Borkovich, Groundwater Monitoring and Assessment Section Chief, State Water Resources Control Board, Division of Water Quality, john.borkovich@waterboards.ca.gov